SALD: Sign Agnostic Learning with Derivatives
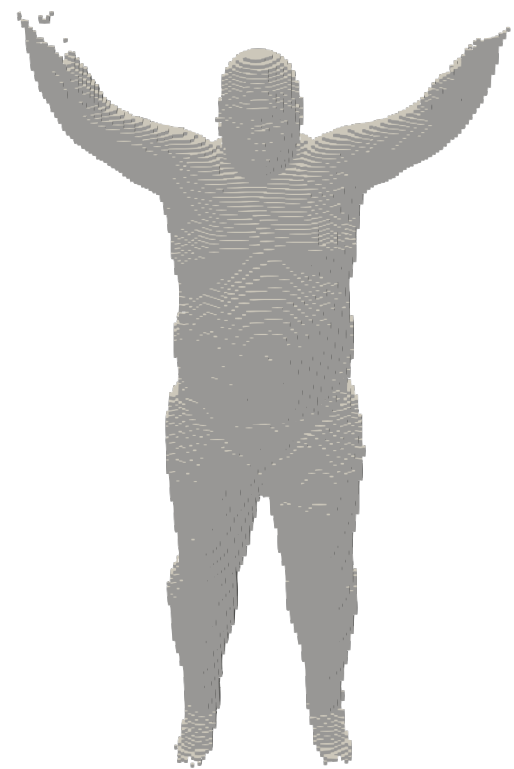
Matan Atzmon and Yaron Lipman
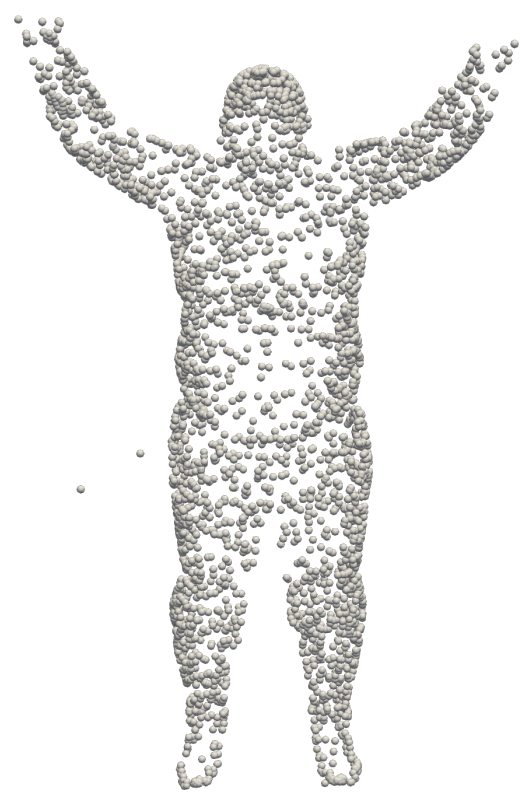
WEIZMANN INSTITUTE OF SCIENCE

Representations of 3D Shapes

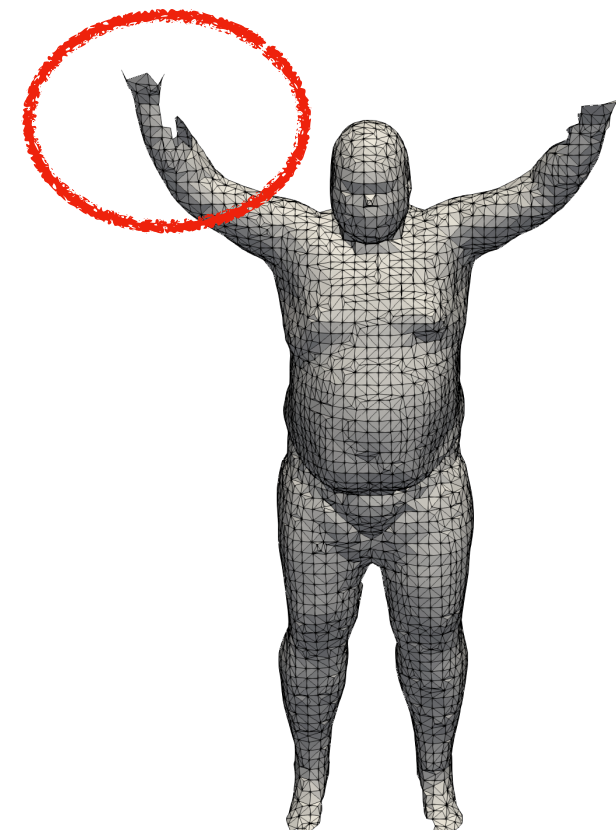## Discrete representations

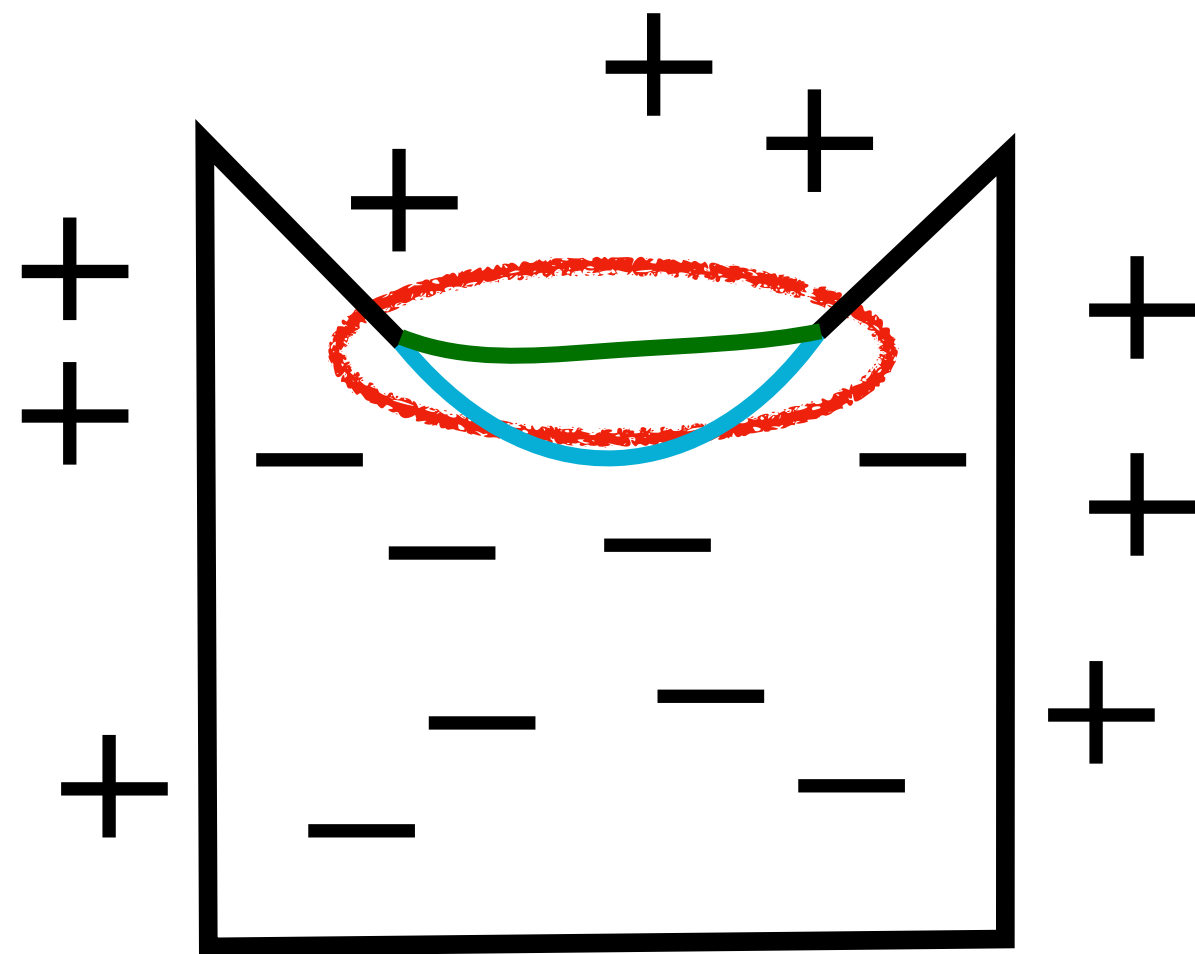**Voxels** **Point Cloud** **Triangle Soup**

Continuous representations

Level Set - $\mathcal{S} = \left\{ x \in \mathbb{R}^3 \,|\, f(x; \theta) = 0 \right\}$

Implicit Neural Representation

Learning Implicit Neural Representations

Toy example

Challenges

✓ • **Learn the inside/outside of an input shape**
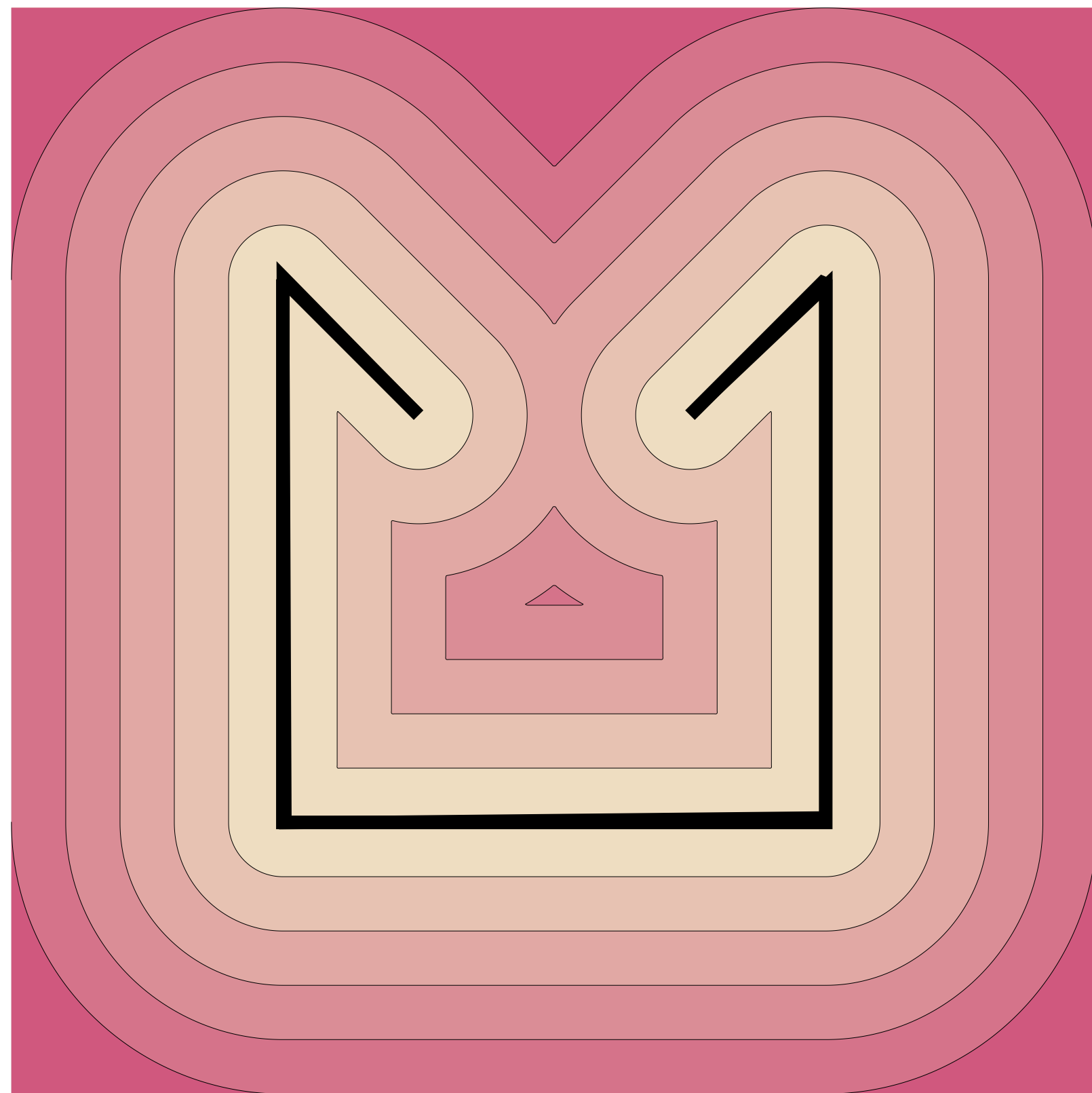
        SAL (CVPR, 2020)   IGR (ICML, 2020)
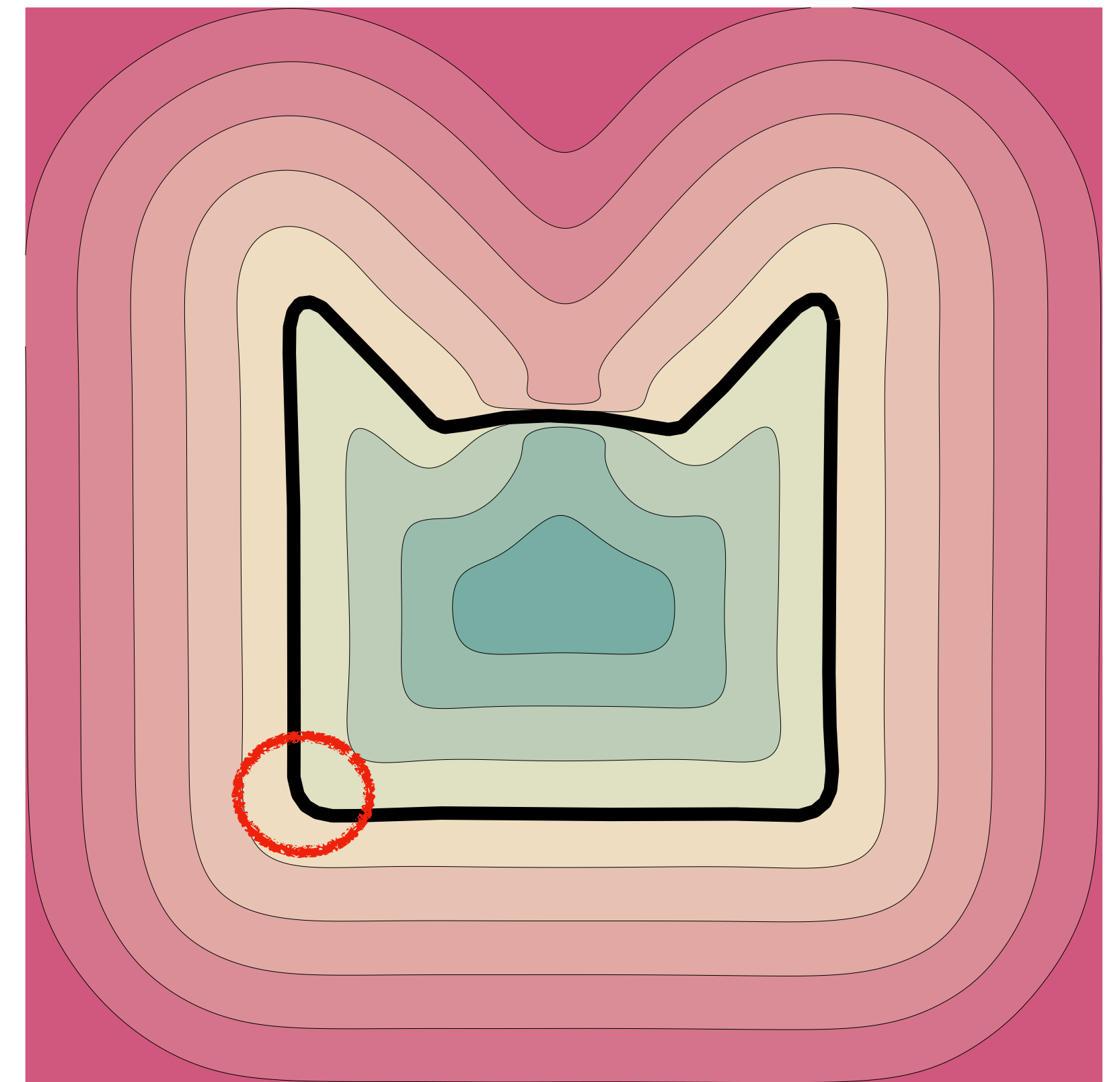
✗ • **Identify how missing parts are learned**

✗ • **High fidelity**

Background : SAL

Sign Agnostic Loss: $\mathrm{loss}(\theta) = \mathbb{E}_x \, \tau\big(f(x;\theta), h(x)\big)$

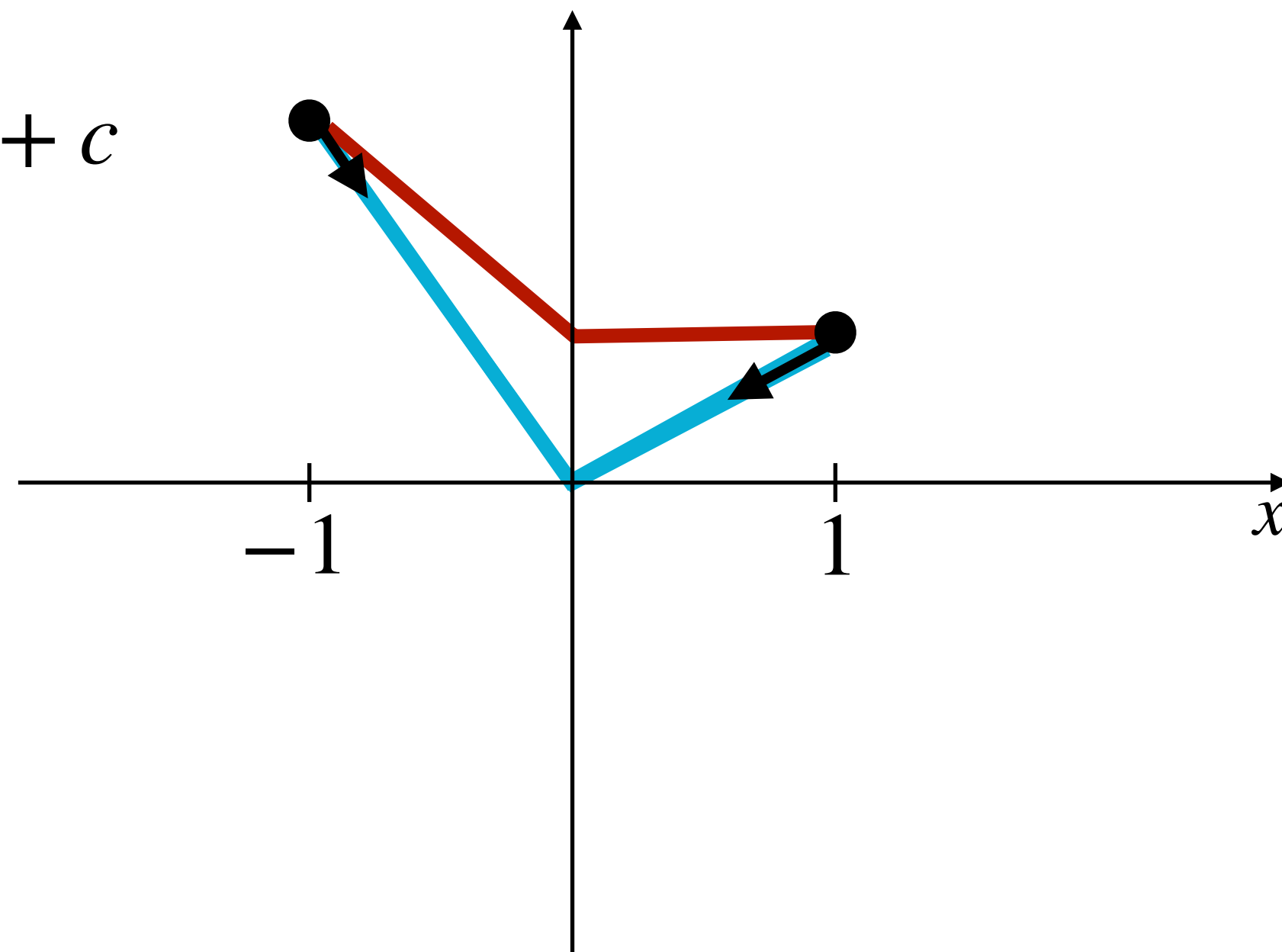$$h(x) = \min_{z \in \mathcal{X}} \| z - x \|_2$$

$$f(x;\theta)$$

Sample Complexity

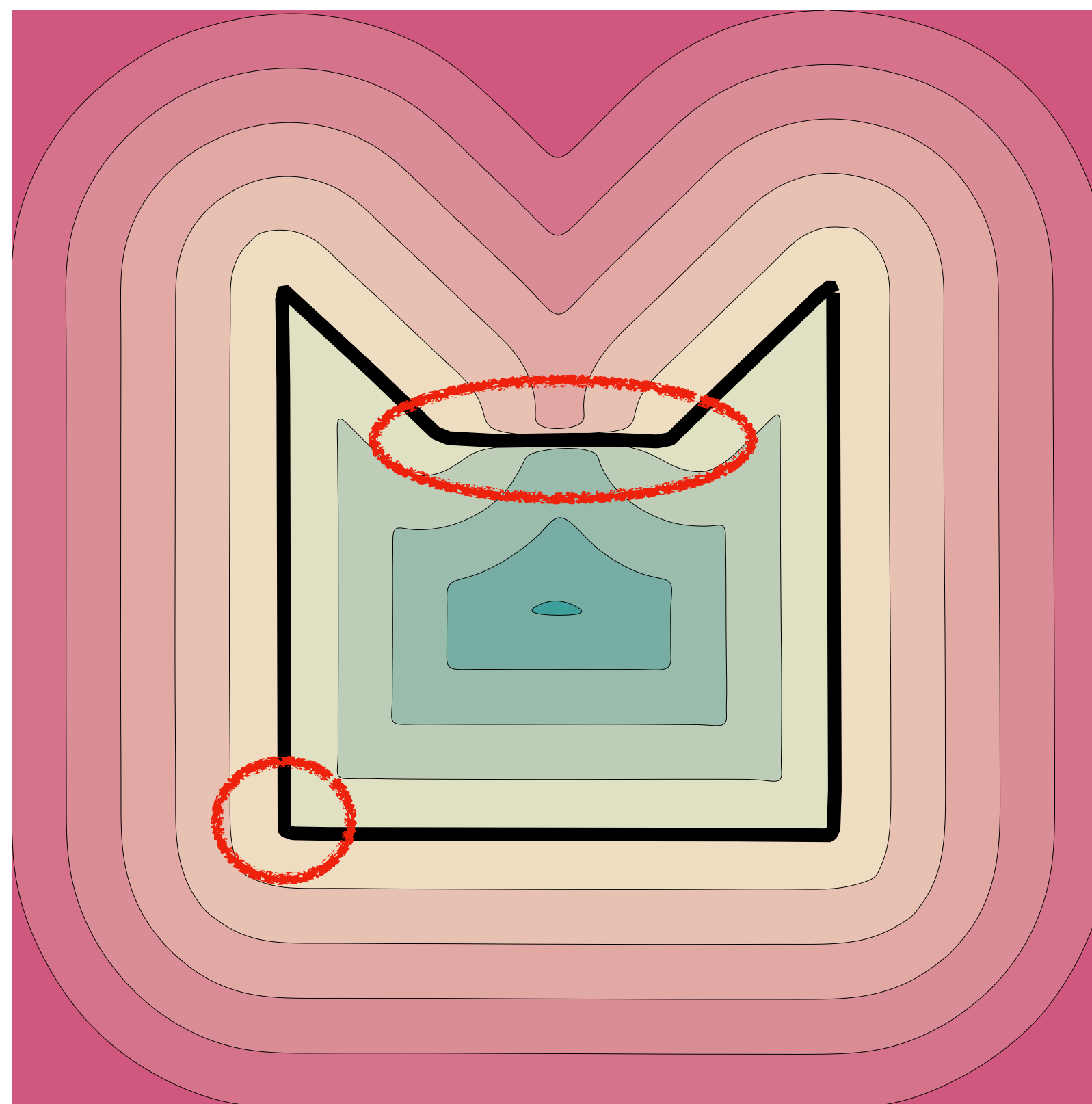$$f(x; \theta) = \max \{ax, bx\} + c$$
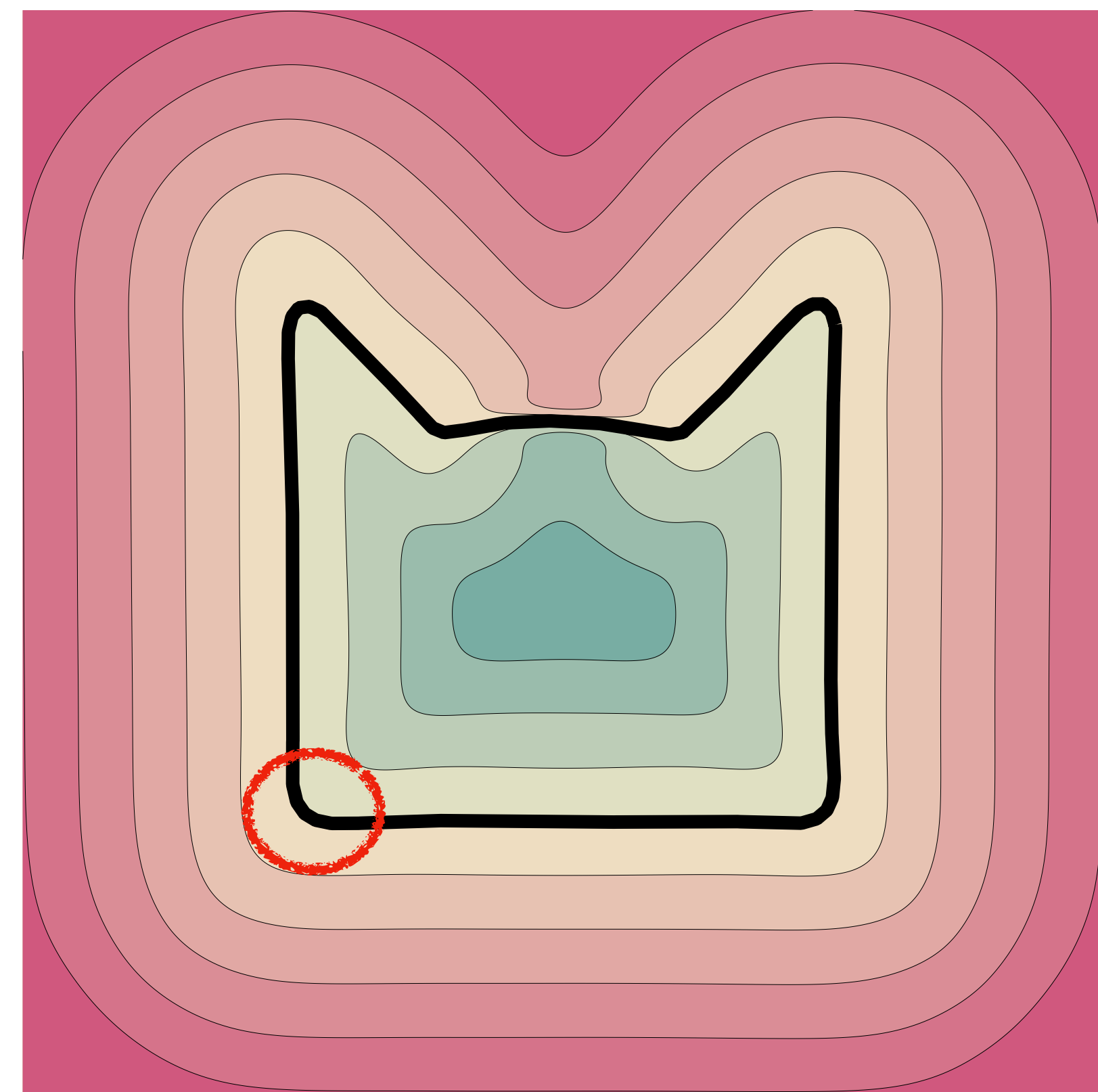
SALD

Sign Agnostic Loss with Derivatives : $\mathrm{loss}(\theta) = \mathbb{E}_x \tau\left(f(x;\theta), h(x)\right)$
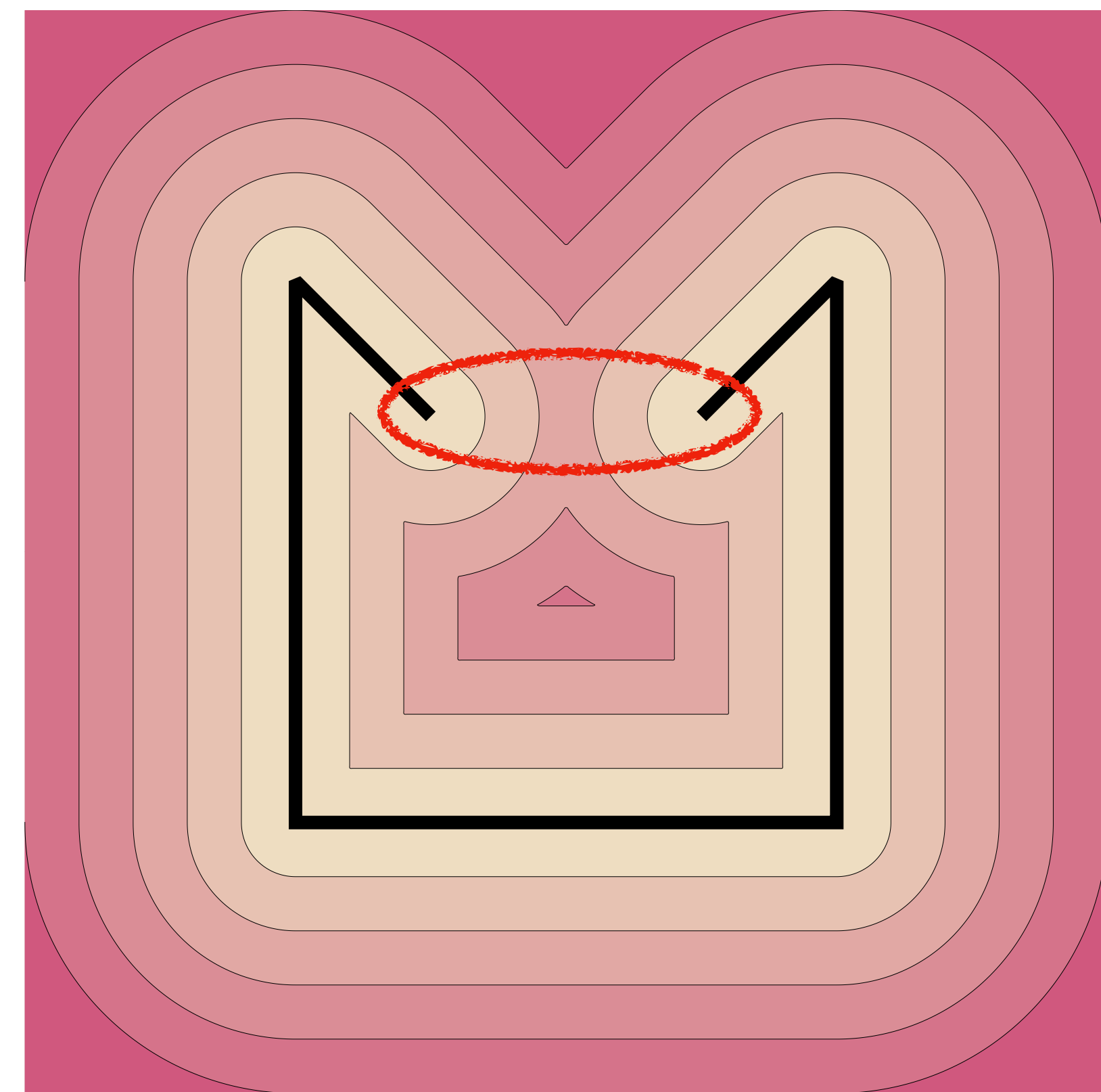
$\{h(x), \nabla h(x)\}$ SALD   SAL
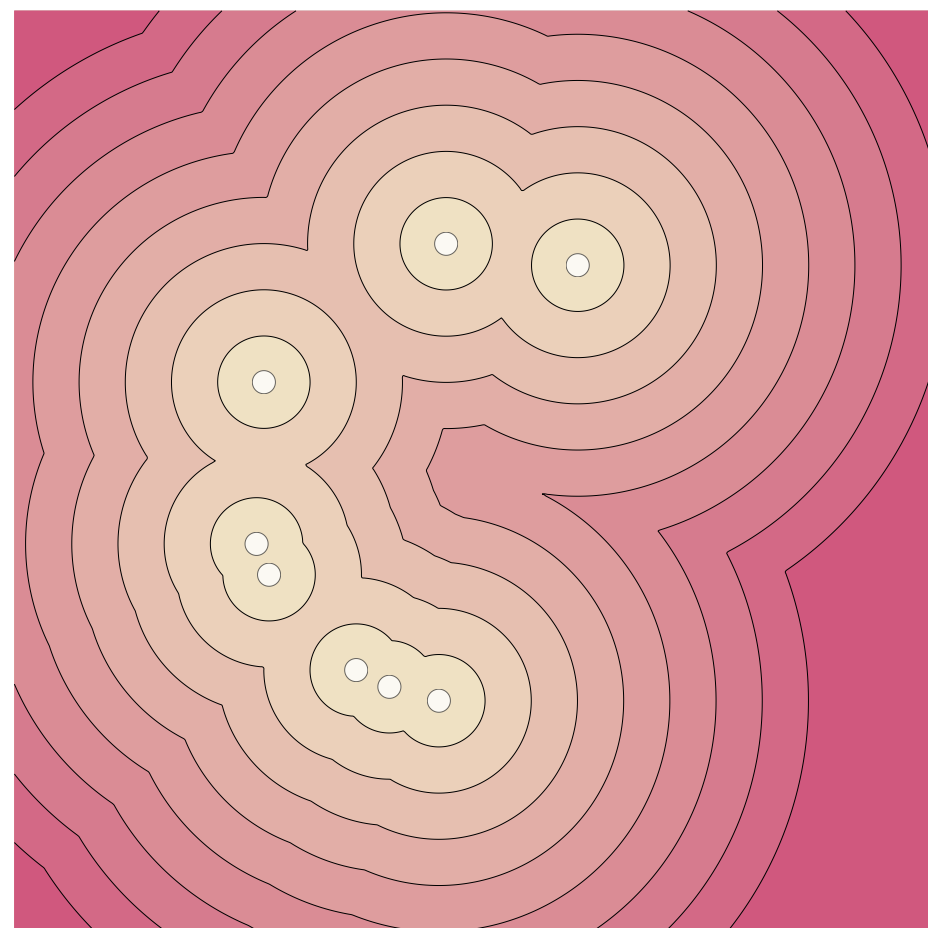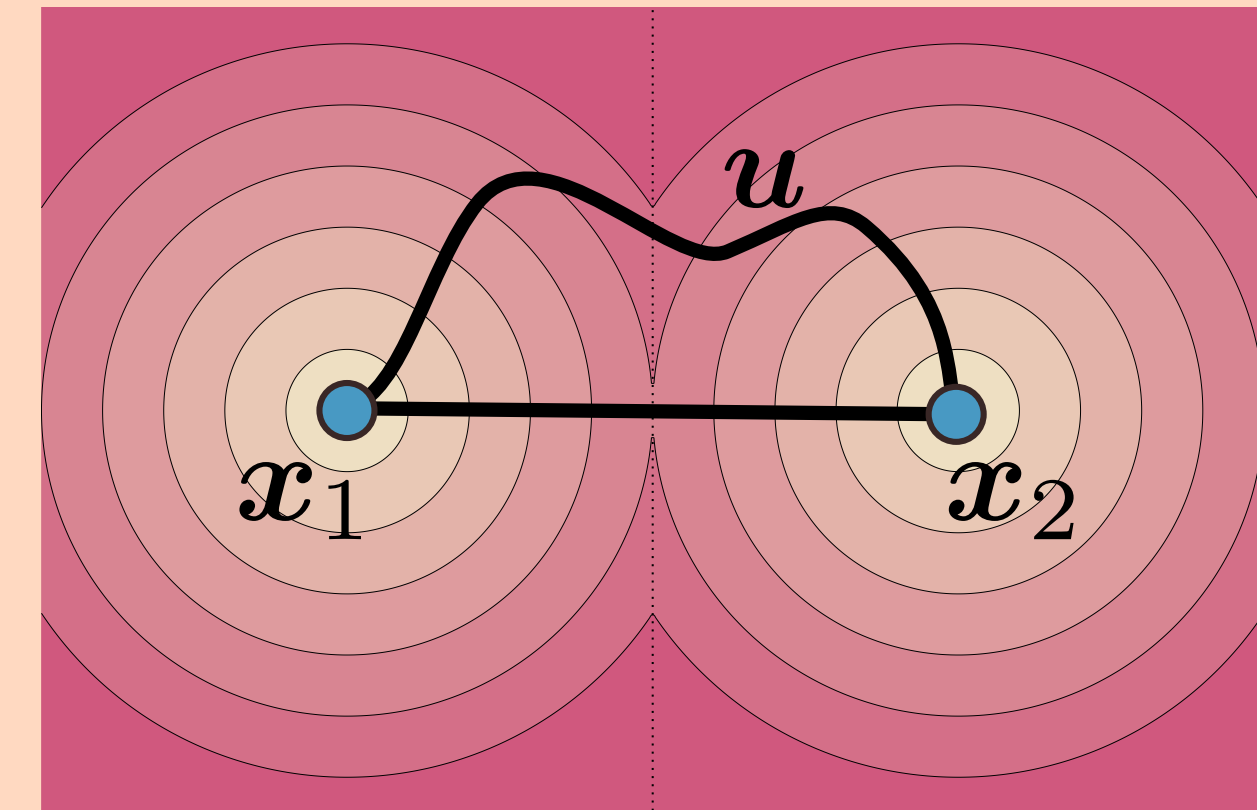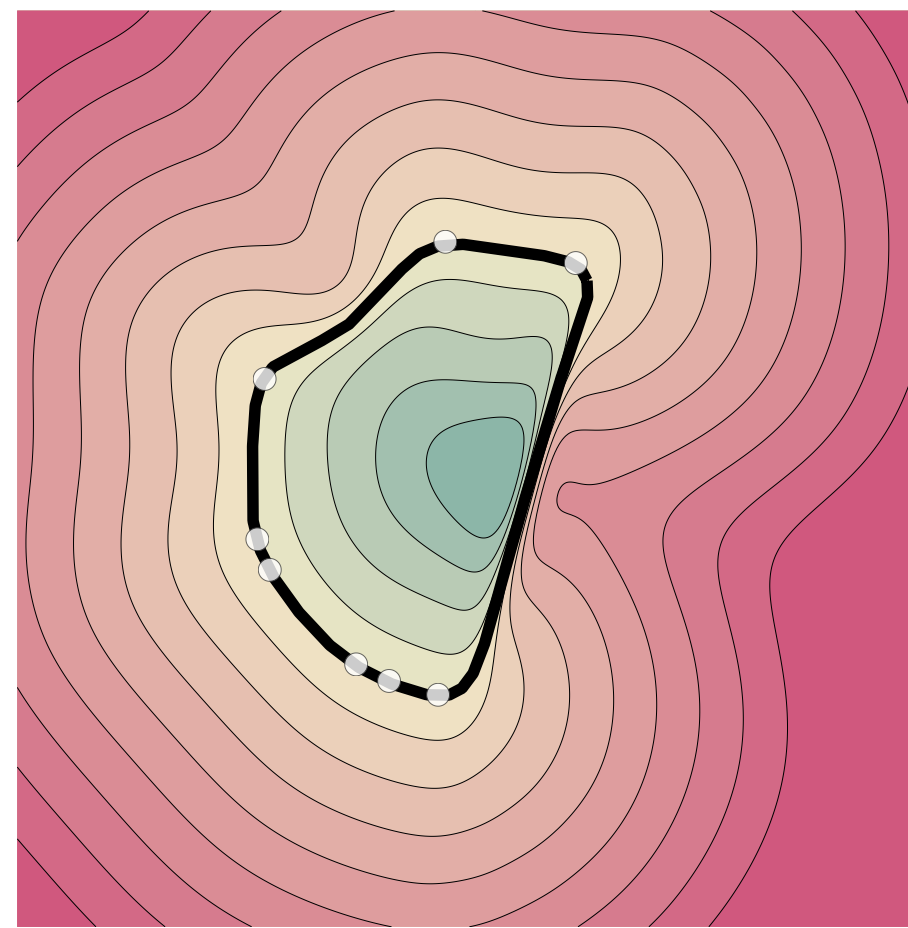
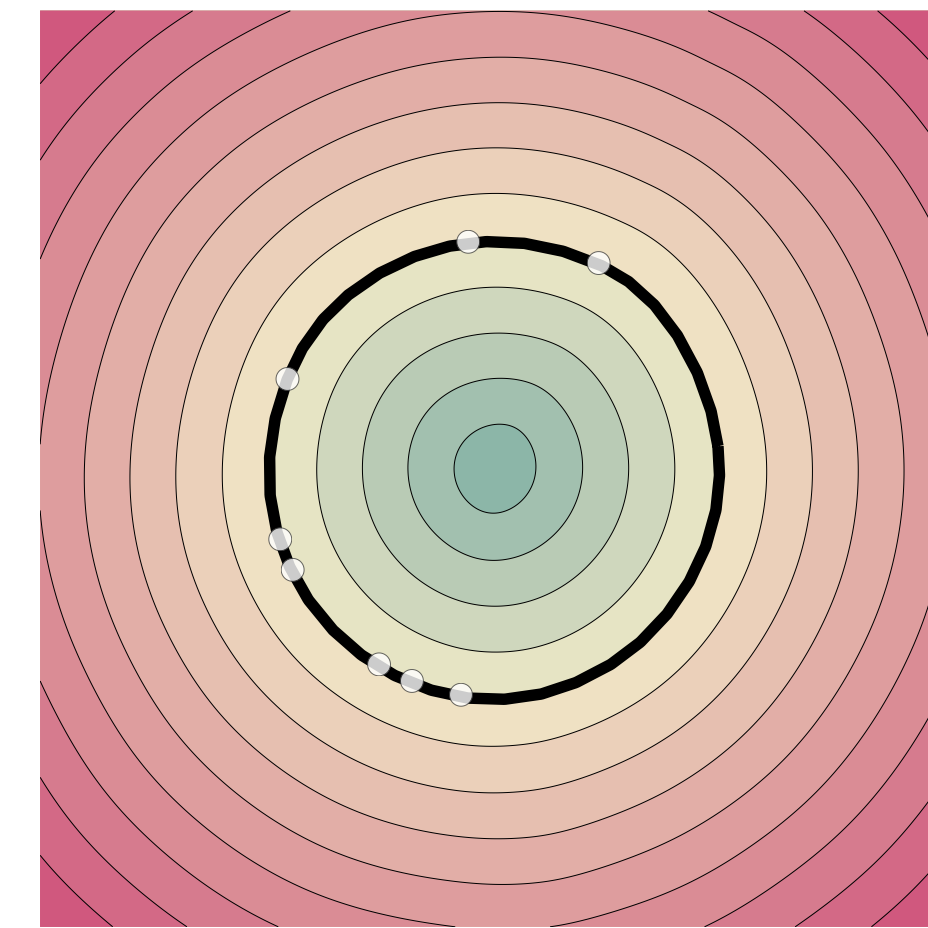# Minimal surface property

Theorem:

Between the two points $x_1, x_2 \in \mathbb{R}^2$,
the straight line is the strict global minimizer for SAL and SALD.
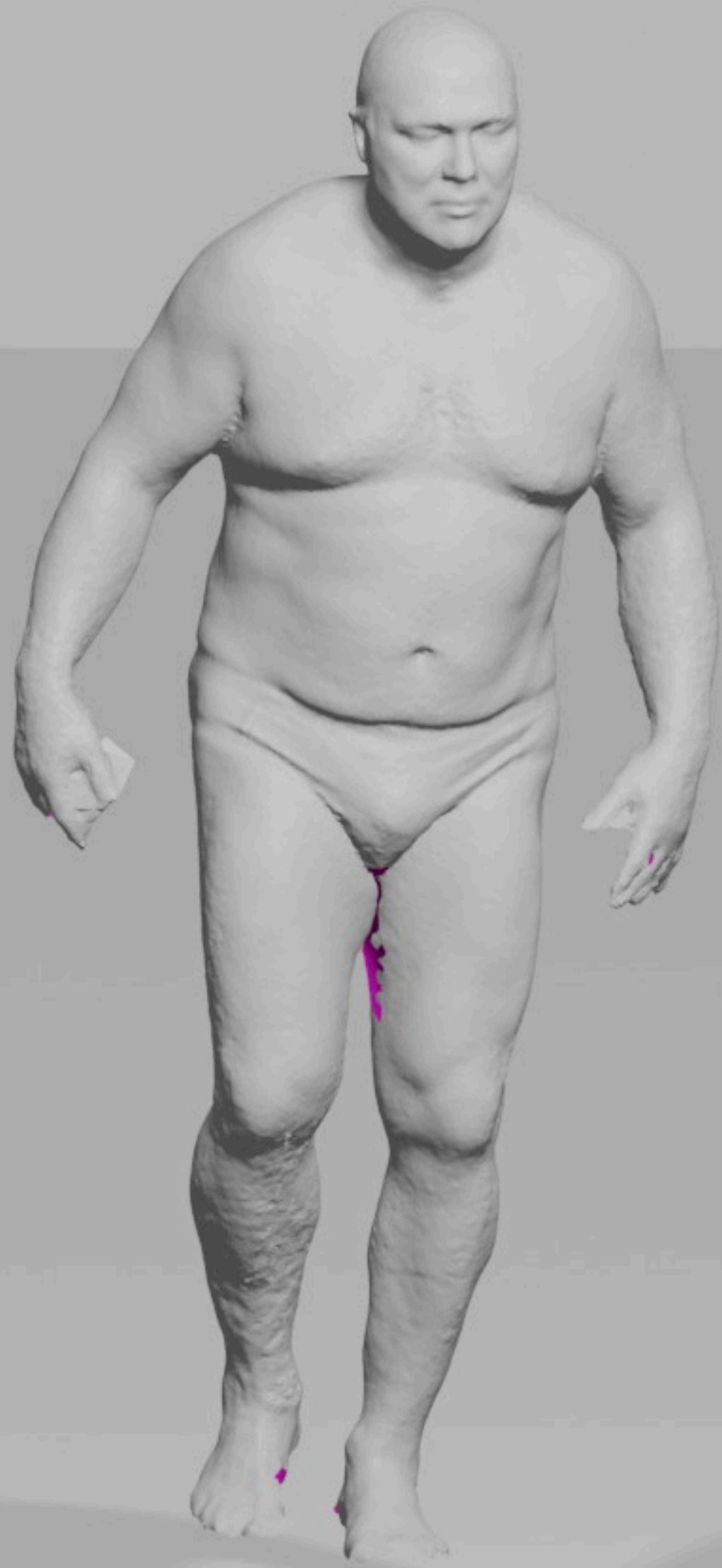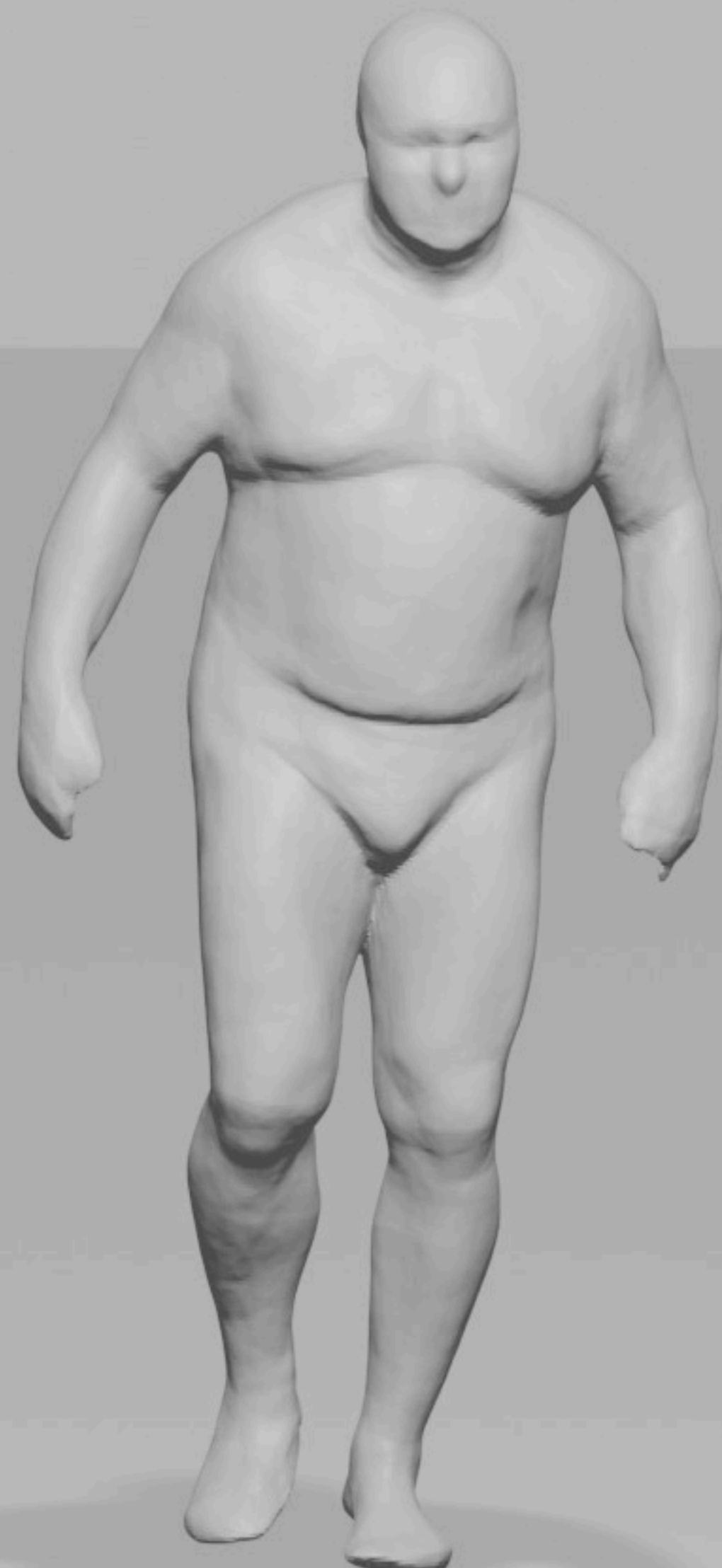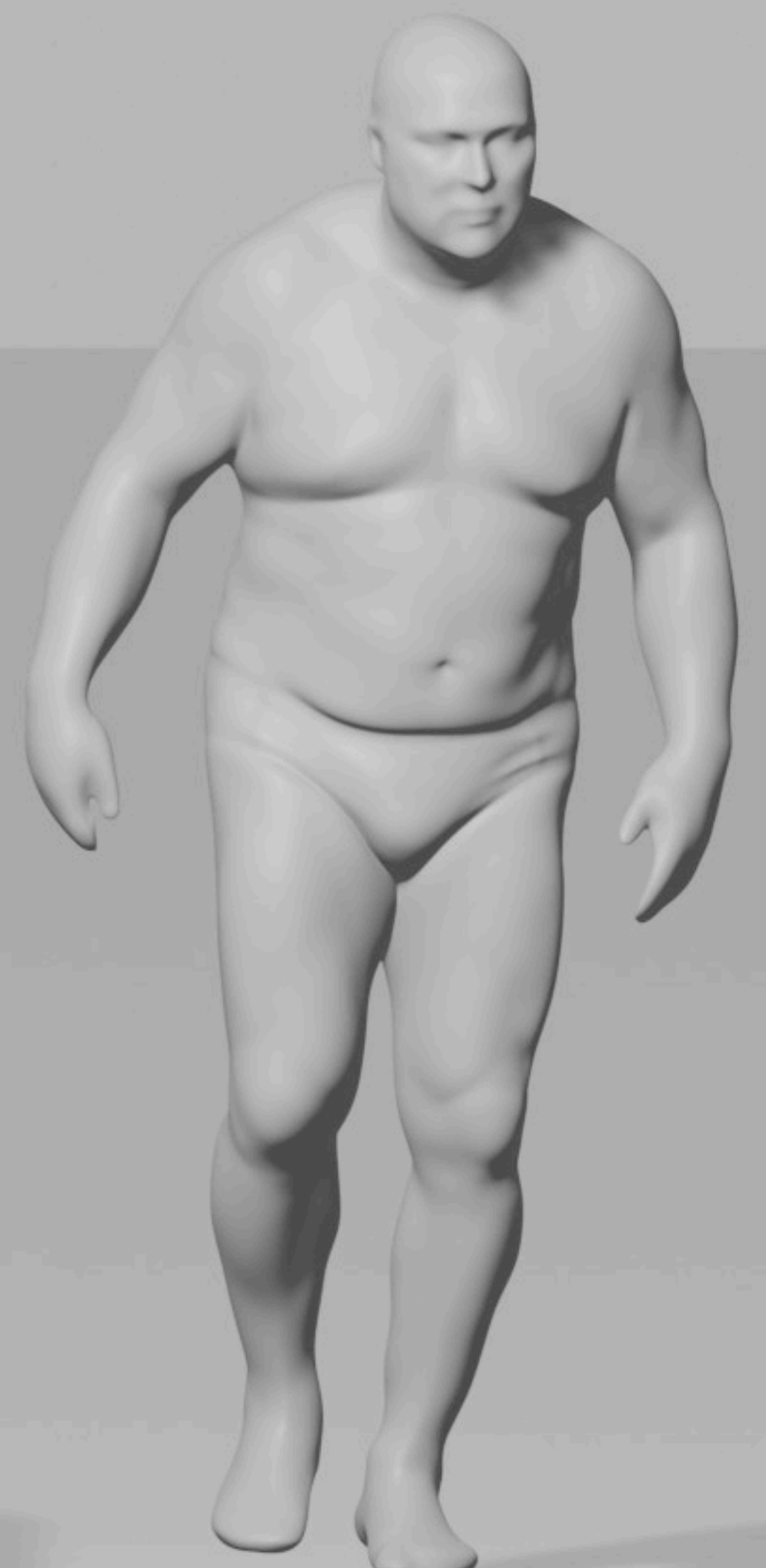
Input

SALD

IGR

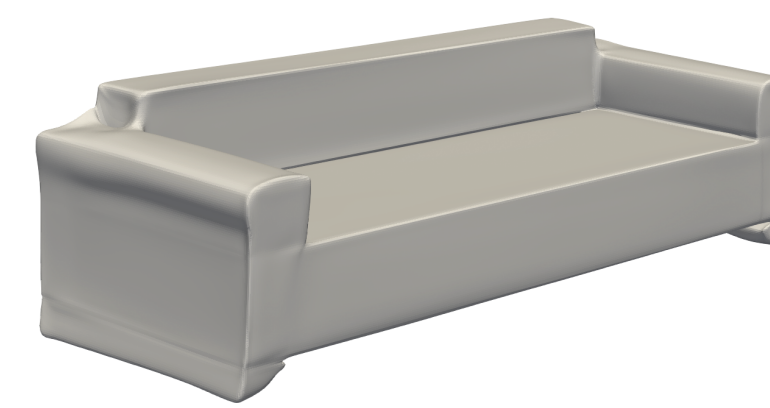# Experiments

DFaust test results

Input   SAL   IGR   Ours
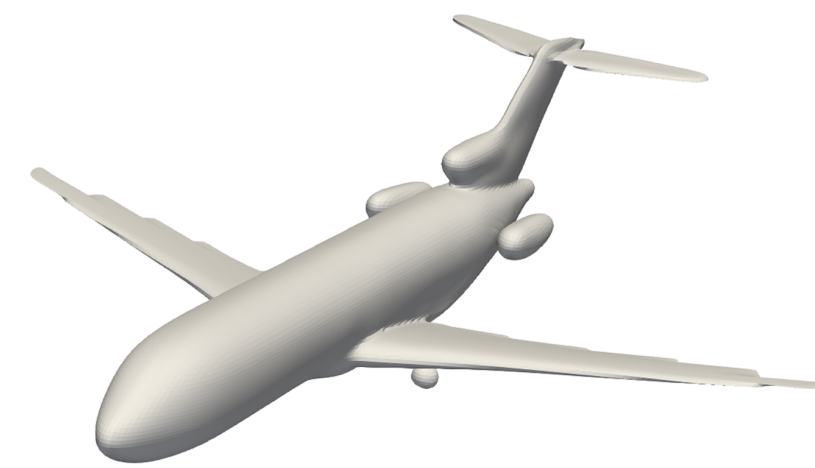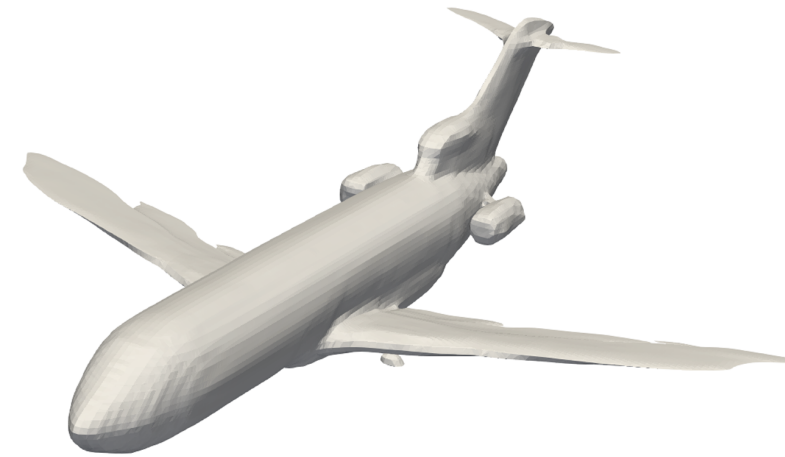
ShapeNet test results
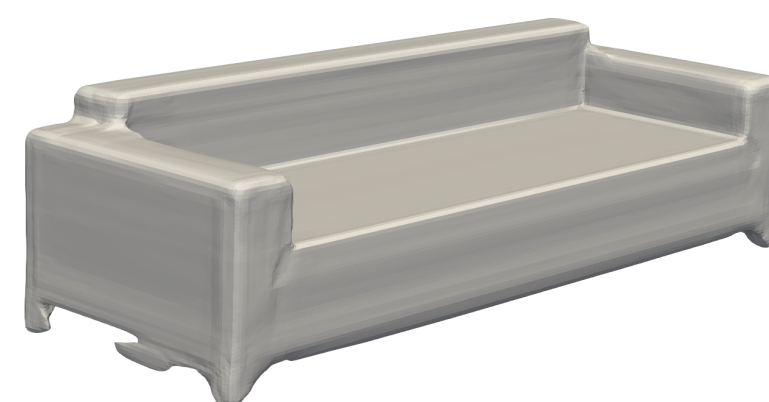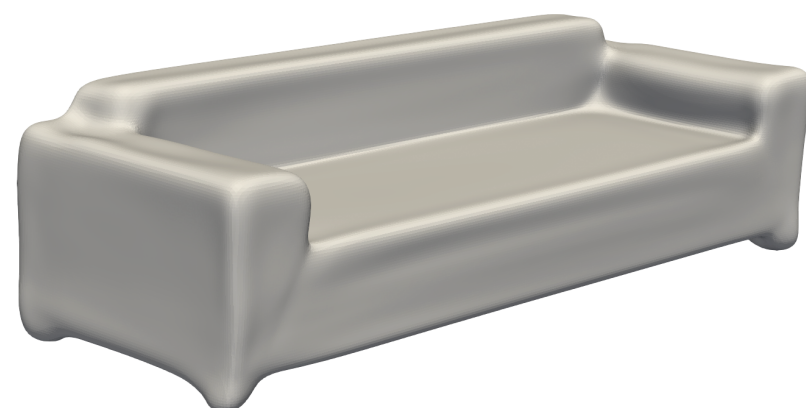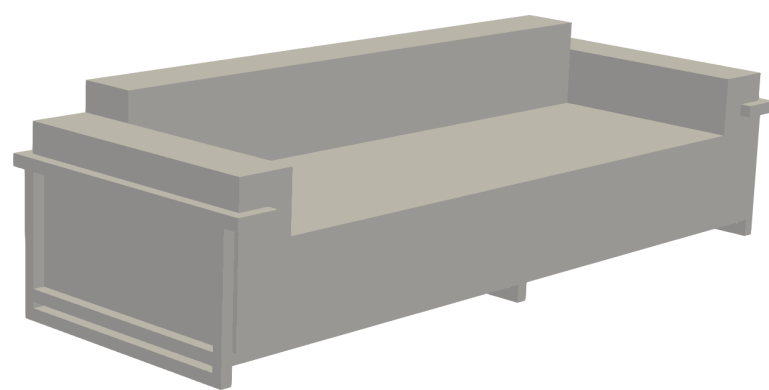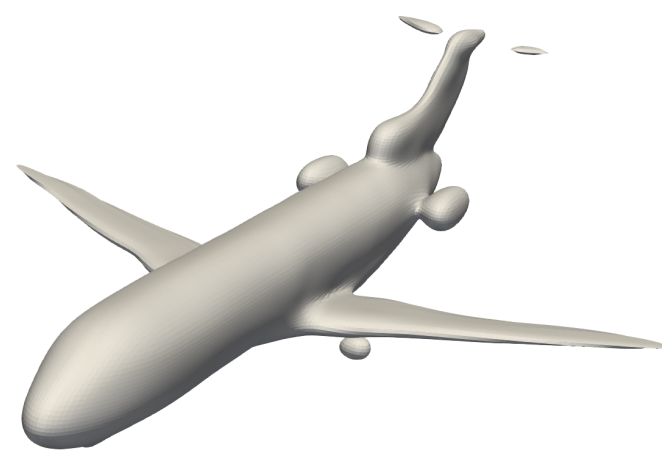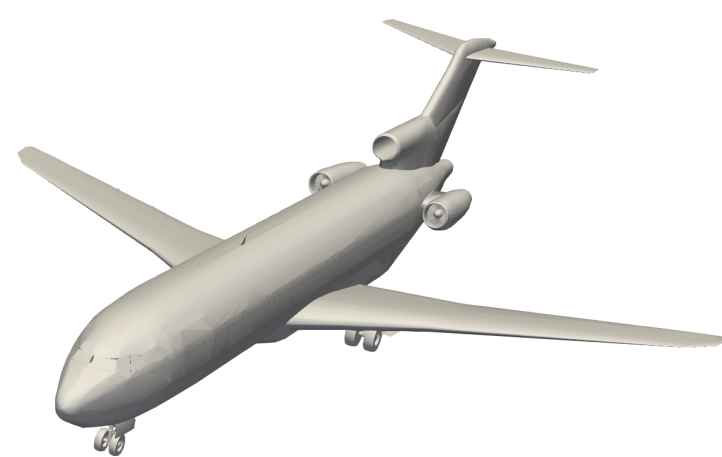
Input   SAL   DeepSDF   SALD

Thank You

Our code will be public soon: https://github.com/matanatz/SALD